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A HISTORY OF CHEMISTRY.

A History of Chemistry. By Prof. F. J. Moore. Pp. xiv + 292. (New York: McGraw-Hill Book Co., Inc.; London: Hill Publishing Co., Ltd., 1918.) Price 12s. 6d. net.

IT is difficult to find excuses for a new "History of Chemistry" which starts from ancient times and brings the story down to the present day. All that can be usefully said about the alchemists and the early chemists before Lavoisier has been repeated many times in the various histories by Thomas Thomson, Kopp, Ernst von Meyer, Wurtz, Thorpe, and others, besides the innumerable special essays such as those of Thorpe and the Memorial Lectures of the Chemical Society. Teachers agree that the study of history in every department of thought is valuable to the student and indispensable to everyone who wishes to understand the present position and how it has been arrived at in each division of physical and natural science. It appears to the present writer that the process of tracing the evolution of ideas in science is most likely to be accomplished best by one who is contemporary with the discoveries which have led to advance and has taken part in discussions arising therefrom. One or two historians in every generation or about every thirty or forty years would be able to record correctly the progress which has been made in his own time. The history of science is not exactly comparable with the history of human affairs, which demands the lapse of a certain amount of time before a true valuation of events and movements becomes possible.

Every writer of a new book, however, doubtless assumes that his work has merits of its own, and it may be at once admitted that this is true of Prof. Moore's "History." But the preface which he has provided makes no reference to previous writers, and is worded as if he thought the task he had undertaken was entirely new. "The aim," he says, "has been to emphasise only those facts and influences which have contributed to make the science what it is to-day." The same claim in similar words has been put forward by many another writer on the same subject. Undoubtedly the book has some features of its own, and the last two chapters, which respectively trace the rise of physical chemistry and set forth, though briefly, the present state of knowledge of radioactive substances and the influence of such new knowledge on conceptions of the Atomic Theory, bring the story down to the present day.

The matter is rather severely compressed, for to include within the space of 271 octavo pages an account of chemical ideas from the times of the Greek philosophers down to the latest conclusions concerning the elements from X-ray spectra and atomic numbers implies a power of discrimination and concise expression, qualities which are not lacking in the author. The book is

written in a brisk and lively style, and the personal biographical touches interpolated here and there ought to serve to whet the appetite for more and lead the student to make excursions into the literature usefully set forth at the end of each chapter. It has to be borne in mind that the lectures, of which the book is the outcome, were addressed to the senior students at the Massachusetts Institute of Technology, the concentration of the text rendering it much less suitable for readers not already familiar with the fundamental facts and principles of the science.

The author shows a sound judgment in setting forth the relative positions and merits of notable persons who figure in the history of the science and about which difference of opinion has been expressed in the past. "Little attention has been paid to questions of priority. A great discovery is usually preceded by a multitude of earlier observations. . . . From the historical standpoint the discoverer of a great truth is usually the one through whose efforts it first becomes available to the race." This remark in the preface is very just. It has always been acknowledged, for example, that oxygen was discovered by Priestley in 1774, and that the same element had been isolated from several sources by Scheele before that time, but the credit of publication belongs to Priestley. There was a tendency at one time in France to ignore Priestley, and in England to disparage the work of Lavoisier on the ground, by no means certain, that he did not "discover" oxygen independently of Priestley. Anyone who has read carefully the "Opuscules," which contain his observations on the calcination of metals and the consequent absorption of a portion of the air in contact, must perceive that this long course of experiment was undertaken with a definite purpose in view, and that the conclusions at which he arrived were independent of anything he may have heard from Priestley about his experiments on mercuric oxide.

The chapter on the periodic law again sets forth briefly all the earlier speculations concerning relations among atomic weights, and arrives at the conclusion that the principle of periodicity was discovered by Lothar Meyer at nearly the same time as and independently of Mendeléeff. Chap. xx., entitled "The Rise of Physical Chemistry," points out that this aspect of chemical science is not exclusively of modern origin. It began as soon as quantitative methods were established in all directions, and the foundations were laid by Lavoisier and Berthollet, and consolidated by the work of Gay-Lussac, Dulong and Petit, Regnault, Bunsen, Kopp, and others. The chapter gives evidence of the influence of Ostwald on the views of the author, who was among his pupils.

A word must be added about the illustrations with which the volume is abundantly supplied. They are all well meant, and many are interesting, but the portraits given are of very unequal merit, and some of them are, to speak frankly, quite bad—those of Mendeléeff and Fischer, for example. It may also be remarked that where the series of

portraits is supposed to recall the founders of modern chemistry and the contributors of fundamental ideas one would expect to find the faces of Cannizzaro, Frankland, Raoult, Ramsay, Crookes, and perhaps several others whose services were at least equal to those of some of the chemists represented.

The book will be found useful by many students and by older chemists who may wish to refresh their memories of the origin and progress of ideas in the science to which they are devoted.

W. A. T.

ELECTRICAL BOOKS FOR STUDENTS.

- (1) *Alternating-current Electrical Engineering.* By Philip Kemp. Pp. xi + 494. (London: Macmillan and Co., Ltd., 1918.) Price 17s. net.
- (2) *Magnetism and Electricity for Home Study.* By H. E. Penrose. Pp. xxiii + 515. (London: The Wireless Press, Ltd., 1918.) Price 5s. net.

(1) IN his preface the author states that this text-book "covers in a general way the main ground included in the title without going into too great detail in any one particular branch." It is intended for engineers and students, and covers the syllabus for the Grade II. (A.C.) paper of the City and Guilds examination. So wide is the field covered that the book is almost an encyclopædia of alternating-current practice. The general reader, therefore, will be disappointed in places owing to the brevity of the descriptions and the lack of full explanations. In a book written mainly for examinational purposes there is not much room for original matter, but some of the proofs are neat and novel, and the author gives a new system of harmonic analysis which we discuss below.

To illustrate the danger of brief explanations, let us consider the definition of a condenser given on p. 50. This produces a blurred mental picture. "When two conducting bodies are separated by a dielectric they are said to possess *capacity*, and the combination is called a condenser." We are not told whether the conducting bodies are equal or not. When a difference of potential is applied we are told that one of the "plates" is positively, and the other negatively, charged. It is not stated definitely whether the positive charge is equal numerically to the negative charge, or what exactly is meant by the charge in a condenser. The descriptions of the Mansbridge and Moscicki condensers do not help the reader to clear up this point, and neither do the analogies given between a condenser and a gas globe, and between a condenser and a rubber diaphragm in a tube.

In the chapter on wave form several methods of harmonic analysis are given. In the first method Fourier's constants are determined by a simple but somewhat laborious evaluation of Fourier's integrals by mechanical quadrature. The method involves some very tedious calculations when high harmonics are required, but it is theoretically sound. In the author's method the

assumption is made that the alternating wave can be expressed exactly by an equation of the form:—

$$e = E_1 \sin(\theta + \alpha_1) + E_3 \sin(3\theta + \alpha_3) + \dots + E_{17} \sin(17\theta + \alpha_{17}).$$

It is then shown that by measuring eighteen ordinates of the positive half of the wave at the points 5, 15, 25, . . . 175 deg. respectively and proceeding in a perfectly regular and simple way we can determine all the values of $E_1, E_3, E_5, \dots, E_{17}$ and $\alpha_1, \alpha_3, \alpha_5, \dots, \alpha_{17}$. A schedule is given by filling up the blanks by which anyone can find these values without excessive labour. This solution is worthy of commendation, as it is much superior to that given by Runge, modifications of which are in everyday use. It has to be pointed out, however, that the author's solution is strictly only an interpolation formula. The Fourier constants are the constants we want in harmonic analysis, and it is highly probable that in most cases the higher harmonics determined in the author's way will only be rough approximations.

(2) In a series of fifty lessons the author discusses the elements of electricity and magnetism and also electrical engineering. We learn from the introduction that during the war he has given instruction in these subjects to a large number of recruits for the Royal Flying Corps, the Royal Navy, the Transport Service, and the Mercantile Marine. There is no doubt that the ordinary academical method of teaching the subject repels many, and so most teachers nowadays—especially those who are not cramped by an examinational syllabus—stimulate the enthusiasm of their pupils by making excursions into the imaginative realms of modern theory. For students of radio-telegraphy this practice is to be highly commended, as familiarity with the theories will be of real assistance when they have to work with valves and rectifiers. The drawback to introducing these theories at such an early stage is that it is bound in many cases to give rise to extraordinary misconceptions. To be told that a molecule must be regarded as a universe composed of several miniature solar systems stretches the imagination, but to accept it without proof and without any statement of its limitations is to expect the reader to adopt an altogether too passive attitude.

There are some strange errors in the book. We are told, for instance, that the existence of the æther is proved by the "lines of force surrounding a magnet in a vacuum" (p. 23). It is stated on p. 208 that the resistivity of a wire is not affected by increase of temperature, although the resistance is. We are also told (p. 303) that if we have two spheres, the surface of one of which is double that of the other, and if they be charged from the same source, then it is "fairly evident" that the charge on one will be double that of the other. Various deductions in capital letters are made from this, which preclude the suggestion that "surface" is a misprint for "radius." The writing is spirited in places, but the words are